United States
Office of Personnel Management

Civil Engineering Series

GS-0810

Dec 1964, TS-54 Jun 1966, TS-62

Additional Available Guidance

See Digest of Significant Classification Decisions & Opinions, Vol. 7 for additional guidance on credit for novel or nonroutine features under Part II, Planning and Design Functions.

Workforce Compensation and Performance Service
Classification Programs Division
June 1998, HRCD-5

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Civil Engineering Series

GS-0810

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SERIES DEFINITION

This series includes professional positions in the field of civil engineering, typically requiring application of general knowledge of the physical sciences and mathematics underlying engineering, and specialized knowledge of (a) mechanics of solids, particularly of soils, (b) hydraulics, (c) theory of structure, (d) strength of materials, (e) engineering geology, and (f) surveying. Positions in this series have responsibility for management, supervision or performance of (1) planning, designing, constructing, and/or maintaining structures and facilities that provide shelter, support transportation systems, and control natural resources; (2) investigating, measuring, surveying and mapping the earth's physical features and phenomena; and (3) research and development activities pertaining to (1) or (2).

The following series are abolished:

Maintenance Engineering Series, GS-0805
Construction Engineering Series, GS-0811
Structural Engineering Series, GS-0812
Hydraulic Engineering Series, GS-0813
Highway Engineering Series, GS-0820
Bridge Engineering Series, GS-0824
Airways Engineering Series, GS-0862

The published position-classification standards for these series (none have been published for the Maintenance Engineering Series or the Airways Engineering Series) are also rescinded, along with that published for the Civil Engineering Series, GS-0810, issued in October 1958.

Not all positions that are classified in the abolished series are to be classified in the Civil Engineering Series. This is especially true of Maintenance Engineering, Airways Engineering, and, to a lesser extent, Construction Engineering positions. While significant numbers of engineers in these three series perform work that is typical of civil engineering, some of them perform work in the electrical, mechanical, or electronics engineering fields. If at all possible, positions should be classified in the single specialized engineering series (e.g., Electrical Engineering or Civil Engineering) that best identifies the paramount knowledges required. Only those positions for which it is not possible to establish that the paramount knowledge requirements are typical of a specialized engineering series should be classified in the General Engineering Series, GS-0801.
(Note: Positions classified in the GS-0801 series can be given classification titles that are descriptive of the work performed, e.g., Maintenance Engineer, or Airways Engineer.)

The tentative draft of this standard proposed abolishment of the Sanitary Engineering Series, GS-0819, since it traditionally has been a part of the civil engineering field. We are postponing

this action, however, until we can conduct a separate study to determine the relationship of positions presently classified as Sanitary Engineers to the Chemical Engineering Series, Industrial Hygiene Series, and Health Physics Series as well as to the Civil Engineering Series.

COVERAGE OF THE CIVIL ENGINEERING SERIES

Nature of program in which positions are located

Civil engineering is performed in a number of different kinds of programs carried out by Federal agencies with functions such as:

- Planning, designing, constructing, and maintaining public word or Government facilities, either directly or by contract.

- Furnishing guidance and control over planning, designing, constructing and maintaining housing, community facilities, highways, airports and conservation facilities, carried out by other-than-Federal Government jurisdictions or by private interests. Such work is done under aids and grants from the Federal Government, or with Federally-insured financing, or under financing by the private interests involved.

- Licensing and regulation of public utilities.

- Surveying and mapping to develop maps and related engineering data.

- Investigating and studying physical phenomena to develop programs and methods to conserve natural resources and control pollution.

Kinds of facilities and systems with which civil engineering positions are concerned

Civil engineering work usually has as its final objective the construction of structures that must be fitted upon, into, or under the earth. Consideration of the nature of soils and/or earth formations in terms of use as foundations, construction materials, channels, etc., is found in varying form in most civil engineering positions.

The following list, while not exhaustive, indicates generally the systems and facilities with which civil engineering is concerned:

- Airfields
- Aqueducts
- Bridges

- Buildings (foundations, walls and structural members)
- Canals
- Dams
- Docks
- Drainage systems
- Earth dredging operations
- Highways, streets and roads
- Irrigation systems
- Locks
- Piers
- Power and pumping plants (excluding electrical and mechanical components)
- Protective shelters, including arctic region ice structures
- Railroads
- Reservoirs
- Sewage and waste treatment and disposal facilities
- Soils structures such as slopes, embankments, levees, foundations
- Storm and erosion protection systems for rivers, harbors, shores, beaches
- Tunnels
- Water supply, purification and distribution systems

Civil engineers are also concerned with the sitting and layout of systems of facilities and structures such as listed above, to obtain optimum utilization of land and resources, and to achieve operational efficiency.

Relationships to other occupational series

Civil engineering positions cannot be completely distinguished from positions included in other series in the Engineering and Architecture Group, GS-0800, either with respect to functions performed or to the kinds of facilities or systems with which they are concerned. The classification of a position to the Civil Engineering Series should be based first of all on a determination that the main orientation or the "mix" of the knowledges and skills required conforms to the series definition.

Although the Architecture Series and the Landscape Architecture Series are similar in a number of respects to civil engineering, they have a major requirement for application of esthetic design considerations which is not basic to civil engineering. On the other hand, they do not require the engineering knowledges of load-carrying structural design and the mechanical properties of materials that are typical of the Civil Engineering Series.

Differentiation between the Civil Engineering Series and the Materials Engineering Series lies primarily in the orientation of the civil Engineering Series toward the use of materials in construction, in contrast to the materials science orientation of the materials Engineering Series.

(See the introductory material regarding this relationship in the standard for the Materials Engineering Series in the October 1964 issue of Position-Classification Standards.)

The work carried out by civil engineers often utilizes or is based partly on data and information that is gathered and developed by persons whose work is within the physical science fields rather than in civil engineering. Because of this, there is sometimes an overlap of functions performed by civil engineers and by persons in physical science occupations such as Hydrology, Cartography and Geodesy in the GS-1300 Group. Series distinctions must be based primarily on the body of knowledges that a position requires, and partly on the techniques, considerations and methods applied in accomplishing objectives. In the physical science occupations, these are aimed largely at investigation and analysis of physical phenomena and characteristics, while civil engineering is largely concerned with the applications to be made of physical data in engineering design and planning. An additional determinant of the choice of the physical science versus the engineering occupational series in some cases is the orientation and pattern of career development within the organization where the position is located.

CIVIL ENGINEERING FUNCTIONS

The work of civil engineers in Government generally fails within the following major functional areas:

Investigations and Survey - Involves the application of civil engineering knowledges and techniques to observe, examine, measure, analyze, map, and describe physical and cultural features and phenomena.

Planning and Design - Involves determination of systems requirements, reconnaissance of site, location, and preparation of designs, specification, and estimates for facilities. (See introduction to Part II of this standard for detailed description.)

Construction - Involves layout and scheduling of operations, and inspection and surveillance of materials, methods, and equipment used in construction. (See introduction to Part III of this standard for detailed description.)

Research - Involves theoretical analysis, development and evaluation of new criteria and methodology in civil engineering. (See Research Grade-Evaluation Guide for further description of the research function.)

Facilities Engineering Management - Includes guidance, development and coordination of programs for the planning, design, construction, and maintenance of facilities with which civil engineering is concerned.

Maintenance and operations work has not been identified as a separate function. Most professional engineering positions in these fields are composed of a combination of *Planning and Design and Construction* functions, or else have responsibilities that are defined under *Facilities Engineering Management*.

Note 1: The identification of a function under this series does not imply that the function per se peculiar to civil engineering. For example, both Planning and Design, and Facilities Engineering Management are functions common to most fields of engineering.

Note 2: These functions do not constitute specializations and are not to be used in titling civil engineering positions.

PLAN OF THE STANDARD

The functional areas defined above are made up of groups of tasks having the same major indicators of difficulty and responsibility, and so provide a practicable basis for definition of classification grade levels.

The civil engineering classification standard will consist of the following sets of grade-level criteria:

Part I - Criteria for grades GS-5 and GS-7 (While these positions do not represent a function, for editorial convenience they have been grouped together as a separate part of the standard.)
Part II - Planning and Design
Part III - Construction
Part IV - Facilities Engineering Management
Part V - Investigations and Survey

This issuance contains criteria for Parts I, II, III, and IV. Positions in the *Research* function are to be classified by reference to the Research Grade-Evaluation Guide.

Evaluation criteria are presented under factors or elements geared to the major grade-level determinants in each functional division. This approach was adopted after it became apparent that covering all functions under one set of criteria would require discussion of a number of different factors or elements, not all of which would be really pertinent to each function.

Some positions contain functions that are included in more than one of the functional divisions under this standard. If one such function is clearly paramount, such a position should be evaluated against the criteria covering that function. If no one function is paramount, the position

should be treated "a mixed position" and classified after evaluating it under each of the various applicable guidelines.

SPECIALIZATIONS AND TITLING

The following specializations and titles are established:

Civil Engineer - Includes all GS-5 and 7 positions which belong in this series and those at GS-9 and above whose paramount knowledge requirements clearly do not fit into one of the following other specializations.

Highway Engineer - Includes positions (GS-9 and above) concerned with highway systems, that require application of knowledges and considerations of economics, route location, mass traffic behavior and vehicle characteristics, and highway geometrics.

Hydraulic Engineer - Includes positions (GS-9 and above) that require application of knowledges of (a) the hydrologic and geologic environment, (b) principles of fluid mechanics and hydraulics, and (c) operational water requirements, with respect to systems and facilities for the development, conservation, utilization and control of water resources.

Structural Engineer - Includes positions (GS-9 and above) concerned particularly with application of the theories of structural dynamics, including distribution of loads, stresses resulting from loads, and strength of materials, to the design or construction of structures, or development of criteria and standards pertaining to such.

The prefix *Research* is to be used in titling positions that are classifiable under the Research Grade-Evaluation Guide. The prefix *Supervisory* is to be used when appropriate.

The Highway, Hydraulic, and Structural specializations defined above are the major ones which can be clearly identified on a knowledge requirements basis and which are generally recognized in the profession. Many positions in this series (in fact, most positions at the GS-11 through 13 levels) have specialized knowledge requirements which are narrower than or different from those typical of these three specializations. For example, a Structural Engineering position with responsibility for design of a large bridge or wind tunnel has to have specific knowledge of dynamic load analysis theory and techniques, which might not be typically required in a Structural Engineer with building design responsibility. However, after careful consideration, it was decided

that any attempt to provide a specialization pattern which could fit all or even most of the typical combinations of knowledge requirements would be both infeasible and of very little real value.

For this reason, it is very important to recognize that, in the analysis and evaluation of individual positions, specific knowledge and skill requirements may have to be identified *within or across* the broad categories provided. These specific requirements can then serve as an appropriate basis for selective placement action.

PART I -- CRITERIA FOR GRADES GS-5 AND GS-7

CIVIL ENGINEER, GS-0810-05

Nature and variety of work

The basic purpose of assignments is to orient the employee in the application of academic theory and basic principles to civil engineering tasks and to ascertain the employee's skills and aptitudes. Work tasks may be similar to those assigned to nonprofessional employees, but such tasks are primarily for training purposes to equip the incumbent to assume more responsible civil engineering duties.

GS-5 civil engineers perform tasks such as applying basic formulas to routine calculations; preparing graphs, curves, and tables for other engineers; recording factual data in tests and observation studies; performing drafting and minor detail design; searching technical reports to obtain information related to supervisors' assignments; assisting in surveying work by operating surveying instruments, staking out locations, plotting alinement and) grades, etc.

Controls over the work

Technical manuals, directives, and criteria are detailed and are directly applicable.

The GS-5 engineer receives specific instructions as to what is required and guidance as to reportsto be used, measurements to be taken, and probable results. Work is checked in progress and upon completion is reviewed for accuracy and validity. Decisions are limited to a simple choice of known techniques to be applied and are not significant at this level.

CIVIL ENGINEER, GS-0810-07

Nature and variety of work

Using prescribed methods, GS-7 civil engineers perform work on specific and limited work assignments or projects normally forming for phases of a broader assignment which is the responsibility of a higher grade engineer. Assignments are typically screened to eliminate difficult or unusual problems. Familiarity with and use of a number of standard engineering principles, methods, and practices are necessary in order to adapt practices and techniques to specific situations, to adjust and correlate date, to recognize discrepancies and deviations in results, and to follow an operation through a series of related detailed steps or processes in carrying out the work assignments. GS-7 civil engineers make tentative and preliminary selections and adaptations of engineering alternatives and, after approval by the supervisor, carry out the sequence of details.

Controls over the work

Although guides are detailed and directly applicable as described at the preceding level, the GS-7 employee must select the most appropriate guides. He must use some resourcefulness planning independently the details to accomplish assignments.

Supervisory control is the same as at the preceding level on new assignments. Detailed calculations, findings, and recommendations on repetitive assignments may be only spot checked to determine accuracy. Reports, designs, and specifications are reviewed in detail for technical accuracy of conclusions, clarity, and format of presentation.

PART II - PLANNING AND DESIGN FUNCTIONS

The following are typical of planning and design functions in a civil engineering organization. A given position may he assigned one or more of the kinds of work listed:

- Investigation, formulation, and evaluation of plans for projects, or for comprehensive developments involving project-systems, considering feasibility in terms of the socio-economic and technological factors present.

- Reconnaissance of site, analysis of data on natural resources and characteristics, consideration of facilities already constructed, uses to be made of proposed facilities, and operational and/or economic benefits to be gained in relation to cost of project.

- Development of generalized plans or statements of scope of work and design criteria, for systems or performance characteristics, and for sitting and layout of facilities.

- Coordination with government agencies (Federal, State or other) and private interests, to achieve maximum realization of various competing or complementary project benefits.

- Assessment of the share of benefits to be derived by various users upon which to base allocation of costs, and, sometimes, negotiation of agreements or contracts on use of benefits.

- Analysis of pertinent data to determine specific performance capacity and operating characteristics of systems and facilities. Data analyzed cover such elements as hydrology, geology, topography, characteristics of soils and vegetation; agricultural and other land use practices; property, mineral and water rights; population density and economic status; present industrial, commercial, residential or other use of land and water areas; natural resources; location of transportation and utility systems.

- Development of detailed designs (criteria, construction or contract drawings, specifications) covering sitting, size and layout of structures; placement and treatment of earth and rock materials in foundations, paving or structures; materials, proportions and placement of load or stress-bearing structural members; materials, shapes and dimensions of structures for holding, transporting, treating and controlling water.

- Estimation of engineering costs for survey, investigation, planning rind design efforts, construction material, equipment, and indirect or overhead expenses.

- Preparation of contract specifications setting forth overall facility performance requirements, items of work and units of measurement and payment, site preparation requirements, methods and processes of construction and installation of equipment, performance requirements of materials and components, methods and control or testing, and the like.

The range or variety of these functions performed in individual positions above the trainee levels corresponds closely to the size and organizational level of the engineering activity in which the positions are located. Many activities that do planning and design work on a variety of projects of considerable scope and cost have rather highly segmented organizations. In such organizations, an engineer position is likely to be confined to one functional area such as investigation and planning of proposed facilities, or detailed design of structures, or preparation of engineering estimates.

On the other hand, in an engineering activity that handles smaller projects, individual positions are usually assigned a range of functions, possibly extending from planning and design to surveillance over construction or operation.

GRADE-LEVEL CRITERIA

These grade-level criteria cover positions that have one or more of the following kinds of responsibility:

- actual performance of the planning and design functions listed above;

- coordination, review and analysis of such work done by other engineers employed by the Government or by contract engineering firms;

- review of plans and designs submitted by applicants for project approval or licensing, such as utility and construction companies, or other government organizations;

- development of techniques and methodology for carrying out these functions (including design standards).

Grade levels are defined in terms of (1) the inherent complexity of the planning and design problems assigned, and (2) the level of judgment and authority exercised. The variety and depth of qualifications required for these positions are reflected in the discussions of the two elements. These criteria were selected as the most significant and constant in differentiating among grade levels.

Inherent complexity of planning and design problems assigned

To indicate levels of complexity of planning and design problems in the grade-level descriptions, the standard uses the term *conventional work* and *advanced work*. *Conventional work* can be accomplished by applying or adapting standard references, criteria and precedents. *Advanced work* requires searching out and selecting laws, formulas, principles and materials, and applauding them to novel situations; this may involve using new methodology, or evolving new design concepts and criteria for systems, structures or material. Obviously, some assignments involve work that falls - somewhere between these two levels of complexity, or represent combinations of the two levels. Some of the examples of assignments in the grade-level descriptions illustrate such work, e.g., Example (4) under GS-12.

Note: While the definition for *advanced work* may appear to have some flavor of "research" work, it does not encompass work with the same purpose or depth as research. See the discussion in the Research Grade-Evaluation Guide, Part I, under the heading *Related Functions*, for criteria by which a position may be determined to fall within the Research category.

Advanced work is required when conditions such as the following are present in the project or assignment being carried out:

- Absence of precedents to follow for the kind of facility to be planned or designed.

- Activities of novel or unconventional nature or of unusually large scope to be served by facility.

- Problems of uncommon site and natural resources features to which plans and designs must be oriented.

- Absence of pertinent controlling data for establishing design criteria.

Complexity is increased also by the presence of such factors as:

- Variety of interrelated operations or activities to be considered, or with which efforts must be coordinated.

- Problems posed in (a) dealing with groups and individuals who have conflicting views on the purpose, size, etc., of a future facility, and (b) balancing these considerations against cost and other practical design and construction consideration's.

- Severe limitations such as greatly contracted time schedules, financial restrictions (flow of currency, procurement of services and materials), or statutory or regulatory limitations on repayment requirements, use of funds, scope of work, and the like.

Level of judgment and authority exercised

This is demonstrated by the:

(1) kind and degree of supervision received;

(2) extent to which incumbent (a) must assess or identify the scope of the assignment or nature of problems and (b) determines the means and approaches to be used in carrying out the assignment;

(3) extent to which there is responsibility for such functions as:

- monitoring or coordinating efforts of contract or in-house personnel in producing plans, designs, estimates, and/or specifications for a project;

- presenting plans and proposals to other agencies, public bodies or private groups to obtain their acceptance and cooperation, to negotiate and to resolve conflicts;

- explaining and justifying proposed project plans before higher authorities or outside groups;

- committing agency to a course of action in conferences or consultations with other organizations in and outside of Government;

- serving as expert advisor or troubleshooter in specialized areas of work; and

- serving as expert witness before hearings, or in court.

GRADE-LEVEL DEFINITIONS

CIVIL ENGINEER, GS-0810-09

Assignments that the GS-9 engineer performs under general supervision usually consist of work similar to that previously done in the organization. Such work can be performed without substantial adaptation or with only minor modifications to standard designs on such things as size of spacing of steel bars to reinforce a masonry structure, or contour and thickness of a retaining wall. These modifications can be worked out by established, commonly applied engineering calculations.

The GS-9 engineer must exercise judgement in selecting, evaluating and applying standard literature, practices and precedents. Work is reviewed for soundness of techniques used and for adequacy and economy of technical results achieved. (In contrast, the GS-7 engineer works under close supervision, obtaining prior clearance from supervisor on minor deviations from standard design.)

The engineer at this level often carries out portions of more complex projects assigned to a higher grade engineer, who provides instructions as work progresses in the application of nonstandard or untried criteria.

Examples of work performed at this level are (1) conducting preliminary site investigations to obtain field data on such things as existing structures, drainage areas, topography, and feasible layout of facilities in relation to terrain; (2) preparing design criteria for smaller or less complex portions of facilities; or (3) developing technical data regarding materials sizes, dimensions, and quantities and costs to be incorporated in formal specifications.

CIVIL ENGINEER, GS-0810-11

At this level, the engineer is expected to be well-versed in the standard theory and practices in the field and to proceed without technical instruction or guidance in applying these to conventional projects or pieces of work. He receives assignments of conventional work with a general indication of results expected, and must identify the limits of the problems involved, the kinds of controlling data needed, and the criteria and techniques to be applied in accomplishing the assignment. Although the work is of conventional nature, it often requires consideration of and selection from several alternative approaches or solutions to problems to arrive at the best treatment form a technical standpoint, and sometimes requires substantial adaptation of

standardized guides and criteria. If there are critical or overriding problems of (1) cost vs. optimum technical solutions, (2) determining the priority of operational needs to be accommodated, or (3) responding to conflicting political or public interest pressures, the GS-11 engineer obtains guidance or decision from a supervisor or higher authority on selection of a course of action.

The GS-11 engineer normally is responsible for coordinating an area or phase of work with engineers responsible for related specialized phases, to arrive a mutually satisfactory approaches and solutions to problems. The engineer may be assisted by, and give technical guidance to, lower grade engineers and technicians who make investigations, collect data, perform detailed computations, do simple design analyses, and the like, in support of the work.

When the GS-11 engineer is assigned work of an advanced nature, such as that shown in examples (2) through (7) at the grade GS-12 level, the supervisor usually defines the limits and objectives of the assignment, and during the course of the work discusses and makes suggestions about the use of untried or unusual techniques and methods. The following is a specific example of such an assignment at the GS-11 level:

Conducts investigations to develop improved design of materials and methods of placing them in construction. For example, studies bituminous paving mixtures for airfield landing strips, to increase their ability to withstand high impact loads, frost action and variations in temperatures, and adverse effects of jet blast fuel spillage. Explores background information (literature, reports, and discussions with others having specialized knowledge of the problems) and consults with supervisor in evaluating information and selecting approaches to the study of the problems.

The following are examples of the kinds of assignments of work of conventional nature performed by an engineer at the GS-11 level:

(1) Prepares designs for structures appurtenant to flood control channels (diversion structures, high retaining walls, closed box channels, simple bridges). These structures are characterized by a variety of loading conditions (combination of live and dead loads, uplift, surcharge, wind and seismic forces), walls intersected by large openings, soil conditions requiring special treatment of footings, pressures of high water velocity, and the like.

(2) Develops competitive bidding cost estimates for a variety of civil works projects of multiple-use nature, or military construction projects in different geographic locations, with different climatic conditions and land characteristics. Determines (a) construction operations and methods involved and the time required to complete each phase or feature, (b) various types and capacities of construction equipment required and cost of operation and maintenance, (c) material types and quantities, and (d) cost of overhead, insurance, tax, social security, etc.

(3) Prepares the preliminary, or planning, design and estimate for single-purpose buildings, e.g., a pumping plant, considering established information and data concerning topography, geology of the foundation, hydrology of the water source area, profile of the discharge line, and requirement as capacity of power production, fish protection measures, and the like. The design covers such items as the excavation required to reach a suitable soil or rock foundation, need for pilings, number and type of pumps and motors, choice of indoor or out-door installation, type and size of discharge line, maximum water surface location and type of intake structure.

(4) Reconnoiters proposed routes and recommends final route selection for railroads or highways through public lands areas by field or aerial surveys; selects the general line of the route or possible alternates to achieve most efficient and economical design from standpoint of grade's, curvatures, cross section, soils and excavation material, incorporation of existing structures and improvements, and maintenance and drainage features.

(5) Utilizing given radiological safety criteria, prepares detailed designs for containers and facilities for shipping, handling, storage and disposal of radioactive materials. Design considerations encompass optimum location of work areas, operations areas, and storage areas; structural integrity; security; fire and flood protection.

(6) Prepares designs and specifications setting forth required capacity, size, location and materials and methods to be used in building varied road's, streets and allied structures in parks and recreational areas. Must consider problems such as the need to preserve landscape features, to build facilities architecturally compatible with surroundings, to hold sight distances to a minimum consistent with safe design traffic speed so as not to despoil large areas, and to provide for heavy water runoff and at the same time locate drainage structures so as not to interfere with recreational uses.

CIVIL ENGINEER, GS-0810-12

The GS-12 engineer must not only be well-versed in standard theory and practices in his/her field, but must have gained further experience and know-how that provide the capability to identify and define the nature and scope of obscure problems, and to project assumptions and derive criteria from inconclusive or variable data. Assignments at this level typically include (1) individual work on advanced planning or design problems, or (2) responsibility for coordinating or monitoring planning and design work that is largely conventional in nature, but which encompasses a number of components obscure problems, and or (2) responsibility for coordinating or monitoring planning and design work that is largely conventional in nature, but which encompasses a number of components or phases of project work.

Assignments carried out individually by GS-12 engineers deal with systems or facilities that (a) encompass a fairly wide range of interrelated elements some of which are conflicting and difficult to reconcile or accommodate, (b) pose critical problems of performance requirements vs. costs, under application of standard materials and criteria, or (c) require designs and plans which must deal with factors of an undetermined or unprecedented nature. The engineer must engage in intensive search and study of the approaches applied and results obtained in similar situations, the findings of research and study on related problems, manufacturer's and laboratory reports on materials and equipment, or other similar sources of information. From such study, and from firsthand investigation and observations, he extends or modifies existing criteria or techniques or develops new approaches to the solution of problems. He may develop prototypes, models or other testing criteria and methods to try out or validate design assumptions and approaches.

In coordinating or monitoring planning and design efforts, the engineer develops schedules for orderly and timely accomplishment of work, arranges for obtaining data and information from outside sources, and advises other engineers on solutions to technical problems.

As at the GS-11 level, the GS-12 engineer is expected to coordinate work efforts with those in other specialties to insure compatibility of approach and optimum results. In addition, the engineer contacts other government agencies (Federal, State, local) and representatives of business and private interests to negotiate differences, to obtain their cooperation in carrying out investigations, to get their clearances, and the like.

The guidance given to an engineer at this grade level is mostly in the nature of an indication of results desired with limits placed by approved project the superioron proposed actions that may require policy decisions.

The following are examples of the kinds of assignments performed at the GS-12 grade level:

(1) Defines criteria for, and gives technical review to assisting engineers in the development of specifications for projects of highly specialized nature, such as facilities to house and support scientific experimentation and systems development operations. Such operations utilize novel mechanical and electrical equipment systems, requiring highly "customized, housing, foundations and utilities. (See Digest 7 for interpretation of "novel or nonrouting.")

(2) In connection with site selection for military facilities, makes special studies of effects of nuclear weapons upon areas under consideration. Searches scientific literature to ascertain effects of nuclear detonations of various sizes and types with respect to radiation, catering and blast overpressures, the contributions of surface conditions, air density and related factors. Analyzes the resting effects on personnel, structures and equipment. Considering these factors and the extent and type of operatic to be housed and supported, selects or recommends most advantageous sites from standpoint of terrain, climatic conditions, room for dispersal of facilities, soil conditions to support protective construction, and the like.

(3) Develops new or modified formulas and methods to be used in investigating and analyzing older structures for load-carrying structural adequacy. Must determine how to detect and measure the altered condition of structural concrete and steel members that have been subjected to deterioration, fracture, fatigue, differential settlement cracking, vibration, etc.

(4) Does preliminary investigations and planning for public work projects, e.g., hydroelectric power development in a river basin, and prepares reports and recommendations that serve as basis for project approval and funding. Ascertains amount of power that can be produced by the facilities (dams and reservoir) that can be constructed in the basin, in relation the other uses which these facilities must serve (conservation, navigation, recreation, irrigation, and the like). Develops preliminary designs and cost estimates based on such factors as the type of, power plant and equipment, including capacity of generating units to Me installed, layout of principal features including intakes, penstocks, powerhouse, tail race and switchyard. Estimates total cost of the hydroelectric power production project, and translates into schedule of annual charges to customers, based on cost of construction, interest, maintenance and operation, amortized over a specified period of years.

(5) Prepares designs for large and complex structures that must withstand a variety of forces (wind, water, seismic) that have unusual stresses because of size and shape, and that call for use of materials or configuration for which experimental data are erratic and inconclusive.

(6) Plans and carries out investigations to develop better or new methods of using soils in, around, or under dams, reservoirs, levees, large buildings, bridges or highways. Applies and analyzes results of test embankments, field pumping and shear strength tests, and various methods of compaction to derive criteria for profiling, placement and treatment of soils materials. Designs and directs installation of settlement gages and compression measuring devices to determine extent of consolidation of soils, embankments or foundations and pore pressures developed in prototype structures, in order to modify or develop new criteria for future projects.

(7) Conducts extensive site investigations of conditions and develops methods to eliminate salt pollution along river basins where this is a major problem. Since there are no long-term or comprehensive records available concerning amounts of salt contributed from various sources or areas, it is necessary to correlate and extend current sampling and measurement data on chemical content of water, amount of loss of salt to ground flow, increase in pollution from land use practices, concentration and stratification of flood flows, volume of runoff from local areas, evaporation rates, etc. Tests and develops designs for facilities and operational methods to abate salt pollution, such as (a) concrete channels and closed conduits through areas of contamination, (b) construction of levee floodways, and (c) pumping of brine to surface ponds or deep subsurface disposal areas.

(8) Furnishes technical guidance and coordinates project work on irrigation engineering matters in an area characterized by considerable variation in physiography, climate, soil conditions and agricultural practices. Construction and operation of irrigation facilities are usually carried out cooperatively under several jurisdictions. As a result, engineers face such complicating situations as variations or conflicts in application and interpretation of water rights, lack of uniformity in organizing and financing operations, differences in methods and standards traditionally applied to different crops and areas, and the like. It is necessary to adapt and modify facility designs and operational methods to accommodate a variety of needs and situations. Consistent with sound design principles, consults and works out compromises with, and gains the cooperation of, representatives of the several jurisdictions and user organizations involved.

CIVIL ENGINEER, GS-0810-13

The GS-13 engineer functions as the technically responsible specialist (in a subject matter or functional area or on a type of facility) in an organization in which work in his/her field constitutes a major activity and presents problems of significant depth and complexity. The engineer is called on for opinions and advice on any matter within or touching on his/her field. The engineer develops procedures and standards for carrying out his/her specialty in the organization, and represents the organization with authority on technical engineering matters within the specialty.

The engineer at this level individually performs advanced work relating to difficult or critical problems, and often leads the efforts of a team carrying out broad project assignments with emphasis in the area of specialization. Such projects normally involve planning or design of facilities, structures or systems characterized by some of the following conditions: a broad range of elements, subsystems or components to meet a variety of operational requirements; unusually difficult site conditions and limitations, or major aspects of environmental conditions that cannot be adequately determined from actual measurement or observation ; novel problems relating to efficiency and safety requirements; and controversial economic and public policy issues. The engineer specialist must apply perception and analysis in depth of the variety of interrelated and conflicting conditions present in such projects; experienced judgment in selecting optimum planning and design approaches from a technical, economic, and public need standpoint; and outstanding skill in representing the activity in connection with the assigned project, to present and explain controlling policies, objectives and needs to cooperating or concerned authorities, agencies, and groups.

The GS-13 engineer performs work within the framework of program and general technical guidelines established by higher organizational authority. Because the engineer is the specialist in his area, the technical aspects of the work (identification and analysis of controlling factors or problems, selection of design criteria and approaches to problem solution) are performed independently, and reviewed primarily to determine that objectives are being properly realized.

The following are examples of the kinds of assignments performed at the GS-13 grade level:

(1) Serves as soils and pavement specialist for airfields constructed in a number of locations in a regional area of the United States and on islands in the neighboring ocean. Developed design criteria for paving, grading and drainage for locations ranging from very hilly terrain, to swamp and marshlands, to coral islands. Runways are subjected to landings of tremendous weight and speed, so safety factors are very critical and require highly reliable design and construction for structural strength and adherence to rigid tolerance for grades.

(2) Coordinates the site investigation and planning for construction of systems and facilities to develop a river basin (normally including substantial areas in several States) for purposes of water conservation and supply, flood control, power development, irrigation, fish preservation, and recreational use. The economic implications are broad and varied, touching upon agricultural, industrial and municipal development. The concerns of various governmental jurisdictions and special interest groups (conservation, recreation), and limitations of established water rights, and the prior interests of already constructed utilities system's present complicated problems as to the type and extent of development that is possible. The engineer must engage in extensive hearings and discussions to ascertain the nature and extent of problems, and to arrive at agreement on objectives and on ground rules for controlling and financing the operation and use of projected facilities.

(3) Coordinates the development of the designs for the water-controlling elements of a system of large multipurpose projects (for flood control, production of hydroelectric power, water supply and navigation). Extensive problems in design occur because of (a) extreme variations in the amount and frequency of rainfall, the topography and the soil characteristics along the river basin involved, and unusual sediment loads and pollutive conditions in the main stream and tributaries these variations pose great difficulty in determining the operating limits and requirements of the components of the system; and (b) the limitations and compromises to which design and operating procedures are subject as a result of the concentrations of population and the considerable agricultural and industrial development; these complicating factors limit the amounts of water available for various purposes, limit the areas available for water storage, transportation and treatment, and make acquisition of these areas extremely costly.

(4) Using an extensive knowledge of engineering methods, practices, equipment and materials, develops comparative engineering cost analyses and estimates that serve as the basis for (a) selection of design standards and construction systems for a nationwide hospital construction program, (b) Congressional appropriations for approved projects, and (c) negotiation of settlements on construction contract changes.

(5) Develops design criteria for highly specialized cold region structures, encompassing foundations and super-structures on ice, snow, permafrost, in tunnels and above the snow.

Applies an extensive and intensive knowledge of the (a) environmental characteristics of polar regions as they affect structural systems, type of construction, connection systems, economy and speed of erection and performance of materials, and (b) mechanics of ice and snow as foundation and superstructure materials.

(6) Conducts, studies to derive structural design criteria for use of materials (steel, aluminum, magnesium, plastics, reinforced concrete and ceramics) in nuclear blast resistant support facilities for weapons systems. Participates as a specialist in these matters with weapons systems operations officials, representatives of other engineering agencies and industry, in planning and design conferences.

CIVIL ENGINEER, GS-0810-14

The engineer at this level functions as an authoritative source of theoretical expertise and practical "know-how" throughout the employing agency, (e.g., a Bureau or national Organization) in a function or program, subject-matter area, or a category of facilities. His/her specialty encompasses projects or programs of major significance, for which controlling theory and practices are in great measure undefined, or in which the operating requirements or engineering methods and practices are in a state of development or are affected extensively by advances in technology. The GS-14 engineer is expected to devise net theoretical approaches for developing criteria and solving problems, to develop standard engineering methods and procedures covering agency operations in his/her specialty, and to give technical review to such operations carried out in diverse locations and circumstances.

Within broadly stated agency objectives and budget limitations, the GS-14 engineer is virtually free to define and develop the technical scope and aims of the assignments and to identify and select fruitful areas within his/her specialty for study or investigation by himself/herself or others in the agency.

The engineer consults with supervisors and coworkers, to ascertain what program developments or projected activities have a bearing on his/her work and to receive guidance for planning and carrying out assigned responsibilities.

The engineer at this level often serves as a member of intraagency panels or boards, furnishing expert advice and representation in his/her specialized field.

The following are examples of the kinds of assignments performed individually by engineers at the GS-14 grade level:

(1) Is an expert in coastal and estatuary protection works, where the constantly, and sometimes greatly, changing physical environment presents many variables and unknowns in planning and

design criteria and critical problems with respect to costs and economics. The GS-14 engineer serves as a roving consultant and advisor to the field activities of an agency where such facilities are being designed and constructed. Initiates investigations and studies to develop design criteria, and to find solutions to critical problems in design, construction, or operation; carries out such studies personally, or guides field or contract personnel specializing in various facets of the problems in setting up investigation, evaluation, and testing projects.

(2) Serves as an authoritative source within the agency on theory and procedures for making stress analyses of concrete structures that depend on stress rather than weight for stability (e.g., high gravity dams, arch dams, Ambursen type dams, and cantilever retaining walls). Plans and carries out investigations, personally or through others, to improve or develop new procedures for the trial load method of analysis, to adapt broad principles of the theory of elasticity to specific problems of analysis to determine effects of temperature changes and seismic forces on stresses and stability, and to apply mathematical processes of analysis through automatic data processing. Furnishes expert testimony at hearings on matters pertaining to safety and stability of structures such as those listed above. Represents the agency in conferences with Federal, State and other government agencies, and utilities firms, for exchange of information and advice on matters within his/her specialty.

PART III -- CONSTRUCTION

Note: The grade-level criteria in this section of the classification standard are intended to cover engineering positions concerned with surveillance and supervision of construction operations. Criteria in this section do not measure responsibility for program development and management, budget justification and funding control. The position of the engineer in charge of a project or geographic area, as discussed in this section, does not include such program management responsibility. (Engineering program management responsibility is covered under criteria for the Facilities Engineering Management function, Part IV).

CONSTRUCTION FUNCTIONS

The following functions characterize the surveillance and control of construction operations, whether carried out under direct Federal construction programs, or under construction programs executed under Federal grants, trust funds, or loans. Although the list is not exhaustive, functions such as those listed should predominate in any position evaluated under the criteria contained in this section.

- Review project plans and specifications prior to contract advertisement to determine practicability from construction standpoint; whether physical obstructions or other

construction difficulties have been anticipated; whether materials selected are readily available.

- Attend pre-bid and bid opening conferences to discuss principal construction features and requirements, in terms of methods and equipment.

- Supervise conduct of detailed site survey; plotting of profiles and cross sections; setting stakes to mark pertinent features; investigating of foundation and borrow pits.

- Develop or review specifications for clearing of land, excavation, building access roads and utilities, construction offices, testing facilities, equipment and material maintenance and storage facilities.

- Negotiate for easements, rights of way, and utilities services as required for construction operations.

- Inform contractor of requirements concerning construction scheduling, progress reporting, safety measures, wage and hour law observance, labor relations, payroll records.

- Observe and investigate construction at all stages to identify problems, take timely action to change designs or recommend changes todesigner to solve problems such as unusual foundation conditions caused by faults, rocks susceptible to solution and landslides, water seepage, behavior of materials, need for treatment of uncovered rock.

- Supervise inspection of construction operations for compliance with intent of design and specifications; interpret plans and specifications; confer with contractor representatives to resolve differences of opinion.

- Investigate need for, contract change orders, considering conditions at work site, field measurements and computations, and local prices, and negotiate costs for changes required.

- Investigate and report on situations in controversy with contractors which either have or are expected to lead to formal claims by the contractor. These may arise from such things as contract changes, labor strikes, unfavorable weather.

- Review contractor's cost breakdowns, progress measurement data, reports of material and equipment used, and field inspection and survey reports, in order to compute periodic payments.

- Record changes and modifications to contract drawings and specifications; prepare "as-built" drawings at completion of construction.

- Coordinate construction operations with contractors and Federal, State and local agencies involved; with railroad, pipeline, utility companies and highway officials on relocation of facilities.

- Keep officials of local jurisdictions informed on project operations, and maintain public relations through news media and personal contact with civic and business groups.

EVALUATION PLAN

Engineering positions in construction operations represent a variety of kinds of assignments in terms of combinations of tasks and organizational relationships, level of authority or responsibility, and scope or complexity of construction projects. To describe probable specific job patterns for each grade level would result in a bulky and repetitive classification standard. In the interest of clarity and ease of application, grade-evaluation criteria in this section are presented under two evaluation elements that apply to the range of job patterns in the occupation.

The two elements used in evaluation of construction engineering positions are: (1) level and kind of authority exercised, and (2) scope and complexity of construction operations. These elements cover the factors of pertinence in evaluating positions of this type. Ranges in these elements are self-evident in the degrees and levels depicted. The point values indicated for the degrees or levels under these elements are to be converted to grades under the Classification Act in accordance with the table on page32.

ELEMENT 1. Level kind of authority exercised

This element is concerned with the kinds of functions performed or supervised by the engineer, and the relative independence and authority with which he carries out these functions.

Supervision over the work of inspectors, technicians, sometimes other engineers, and, in some cases, administrative personnel, is an integral part of the responsibility of engineers who exercise surveillance over construction operations. Supervision over the work of others is "net reflected directly in this standard, however, in the definition of degrees or levels. The nature of supervisory authority and responsibilities directly related to (1) the kinds of functions performed, and (2) the scope of construction operations under the engineer's control. These factors are used to define degrees and levels in this standard, the first under Element 1 and the second under Element 2.

Engineers may perform functions associated with the "office" or the "field" side of construction operations, or they may perform a combination of these functions. (We use the designations "field" and "office" only for the sake of convenience; the setting or location in which the functions are performed is not important.) Different kinds of authority are normally associated

with the two kinds of functions, and these are indicated in the degree definitions under this element.

The degree of independence with which the engineer carries out these functions is generally related to the location of his/her position in the construction surveillance activity. For example, the engineer in charge of construction operations for a project usually makes decisions on certain questions, thus restricting the independence with which an engineer in charge of a shift of operations or of even a major portion of the project may act in those areas.

Assignment of degrees under Element 1

Element 1 has a range of 5 degrees, A through E, with point values of 20, 30, 40, 50, and 60, respectively. Only these specific values are to be assigned.

Degrees A, C, and E are defined in this standard. They depict three common levels of authority in construction project organizations. Degrees B and D are not defined, but are to be used when a position falls between the defined degrees. They are especially for use in complex construction organizations established for large-scale construction operations. For instance, an engineer may be more independent, or less. independent, in carrying out assignments than is indicated as typical for the defined degrees. Thus, where an assistant to the engineer in charge assumes the higher level authority ordinarily found in a position in charge of a major portion of a project (normally degree C) the assistant position could be evaluated at Degree D, and the subordinate positions that would normally be assigned Degree C would be assigned Degree B instead. Degree D could apply also to the position of an engineer in charge of a project or a subproject whose authority is more limited than that described under Degree E. Degree B could be assigned to a position in charge of a portion of a project that would not be classed as a major portion, such as required for Degree C.

Definition of degrees under Element 1

Degree A (20 points)

Performs one or more of the "field,' or "office" functions described below, with respect to such assignments as (1) supervision of inspection of construction operations on a shift, or (2) surveillance over limited, specialized phases of construction operations, such as earth compaction for a dam foundation, or (3) for negotiation and preparation of all contract change orders and, modifications. The addition of one or more functions of the same kind ("field" or "office") does not affect assignment to Degree A.

There is normally at least one intermediate level of supervision (and sometimes more) between positions evaluated at Degree A and the position of the engineer in charge of construction on a project or in a geographic area. Employees in Degree A generally have authority to recommend only, and take no significant final actions without review or consultation. The supervisor is consulted and gives guidance on controversial issues that arise in dealing with contractors, or on actions that require changes in contract terms, agency technical standards or policies, and the like.

"Field engineering"

- Supervise conduct of detailed site survey; plotting profiles and cross sections; setting stakes to mark pertinent features; investigation of foundation and borrow pits.

- Develop or review specifications for: clearing of land, for excavation, and for building of access roads and utilities, construction offices, testing facilities, and maintenance and storage facilities.

- Negotiate for easements, rights of way, utilities services for construction operations.

- Supervise inspection of construction operations for compliance with, specifications; interpret plans and specifications; confer with contractor representatives to resolve differences of opinion.

- Investigate need for and prepare engineering data for change orders, considering conditions at work site, field measurements and computations, and local prices, some-times discussing and working out details with contractor personnel. (This work is often found in office engineering positions.)

"Office engineering"

- Investigate and evaluate capability, methods of operation, and equipment of low bidder on construction contracts.

- Investigate need for and prepare engineering data for change orders, considering such matters as conditions at work site, field measurements and computations, and local prices, sometimes discussing and working out details with contractor personnel.

- Investigate and report on situations in controversy with the contractor which either have or are expected to lead to formal claims by the contractor (contract changes, labor strikes, unfavorable weather).

- Review contractor's cost breakdowns, progress measurement data, reports of material and equipment used, and field inspection and survey reports, to determine their accuracy and adequacy for computing periodic payments.

- Record changes and modifications to contract drawings and specifications; prepare "as-built" drawings at completion of construction.

Degree C (40 points)

In a position assigned to this degree, in contrast to Degree A, the engineer is usually responsible for one of the major portions of constructive activity on a project or in a geographical area. A "major portion" would be sc work as (1) the clearing and building of the reservoir and construction of roads, bridges, rail-roads, and utilities that have to be relocated in connection with construction of a large dam; (2) construction of the canals for an irrigation system; or (3) the entire "field" or "office" engineering phase of construction activities.

An engineer whose job falls at this degree normally reports directly to the engineer in charge of construction either on project or in a geographic area. The engineer in charge exercises control mainly by establishing the organizational framework and the overall contractual requirements and interpretations under which work is to be accomplished. The engineer at this degree is expected to be fully conversant with construction systems, practices and processes.

The engineer's position at Degree C typically involves performance or supervision of substantially the full range of either the "field" or "office" engineering functions associated with construction operations. (See the listings of these functions under Degree A.)

! The engineer responsible for "field" functions has authority to:

- establish detailed inspection requirements, schedules add control methods.

- interpret contract specifications pertaining to his/her phase of construction and determine whether construction meets contract requirements. In case of defective workmanship or non-compliance with contract, initiate action to with-hold payment.

- recommend changes in designs, specifications and schedules to accommodate conditions at construction site or to expedite construction.

! The engineer responsible for "office" functions has authority to:

- determine adequacy and validity of contractor's measurement data, and amount of periodic payments due contractor.

- determine whether construction is progressing in accordance with contract schedule requirements, and prepare technical reports setting forth progress status, and any contract action needed to correct deficiencies; prepare contract change orders and negotiate cost of minor changes with contractor's representative.

Degree E (60 points)

Serves as engineer in charge of a construction project or of construction activities in a geographic area. Carries out the full range of field and office engineering functions, usually through a staff of subordinate supervisors.

As the engineer in charge, is responsible for the following functions:

- Participate in design review conferences with agency designers or Architect-Engineers, those who will operate or occupy the facilities, or other interested parties, to discuss construction aspects and problems.

- Review project plans and specifications prior to contract advertisement to determine such things as practicability from construction standpoint, whether physical obstructions or other construction difficulties have been anticipated, and whether materials selected are readily available. Attend pre-bid and bid opening conferences to discuss and clarify principal construction features, and inform contractor of requirements concerning construction scheduling, progress reporting, safety measures, wage and hour law observance, labor relations, payroll records.

- Exercise overall coordination of construction planning and scheduling with contractors and Federal, State and local agencies involved; with railroad, pipelines, utility companies and highway officials on relocation of facilities.

- Observe, investigate construction at all stages to identify major problems, and take timely corrective action (for example, unusual foundation conditions caused by faults, rocks susceptible to solution and landslides, water seepage, need for treatment of uncovered rock).

- Keep officials of local jurisdictions informed on project operations, and maintain public relations through news media and personal contact with civic and business groups.

The engineer in charge has final authority to:

- Approve contractor's construction schedules and quality control procedures.

- Make controlling interpretations of intent of drawings and specifications, and final engineering determination on whether methods and materials employed meet the requirements of contract specifications and will result in safe structures. (Finality of project or area engineer's determination in these matters does not preclude submission of claims by contractor, which are acted upon by Government Contracting Officers.)

- Determine that contractor's operation complies with wage and hour or other applicable labor laws and regulations.

- Determine that contractor is properly recording work accomplished and materials used. (In any case of non-compliance on the part of the contractor in these matters, initiates "stop work" order.)

- Organize, assign and control work of assisting engineers, inspectors, technicians and administrative personnel.

On construction operations and engineering matters, the engineers in charge makes determinations and takes action virtually without review. With regard to basic design or materials specifications, the engineer's approval authority is normally limited to changes which would have only minor effect on the nature, scope or cost of the facilities being constructed. He is expected, however, to determine the need for, and the controlling site conditions to be considered in, major design changes dictated by the construction situation.

ELEMENT 2. Scope and complexity of construction operations

The definitions of levels under this element encompass a number of considerations, chief among which are:

Size of projects -- Size can be only roughly identified in terms of dimensions, geographic dispersion, length of time required for construction, and similar considerations. There is no absolute or constant progression in any of these elements in or by themselves, to mark off levels of size. For instance, the relative dimensions and geographic dispersal of levees or of canal systems that may extend several hundred miles in one project, as compared to the land area and size of buildings in a hospital: suggest very little about the relative scope of construction operations involved. In particular, various situations may influence the length of time required or allowed for construction of a project. Some projects may be telescoped, with work carried out simultaneously in several locations under several contractors. The accelerated schedule for such projects usually requires a larger surveillance staff than if work were completed in normal sequences, the critical time-phasing requires more concise planning and presents considerable difficulty in coordination and control.

The ranges in these "size" considerations portrayed in the level definitions can only suggest approximate and relative characteristics, and must be applied only" in the light of other considerations such as listed below.

However, generally speaking, greater size increases the problems of scheduling and coordinating contractor operations and work of subordinate staff engineers, inspectors, technicians, etc. Further, in most cases, the larger the project, the larger and more varied is the public with which the engineer must deal in clearing the way for and accomplishing construction operations.

Diversity of structures or facilities --Variety in types of structures in a project presents problems in scheduling and coordination, and requires broader knowledges of construction methods and practices than would he applied to one or two kinds of structures alone. Variety of projects in a geographic area for which the engineer is responsible, with the attendant increase in problems of scheduling and control, and number of contractors or "publics" with which the engineer must deal, also adds to the complexity of the assignment.

Installation of technical or" specialized facilities -- Construction or installation of some facilities requires use of highly specialized or novel equipment and methods, as well as exacting control of operations. Such assignments demand greater coordination and engineering skills than construction of conventional, non-technical facilities.

Problems posed by construction site -- Rugged terrain, unstable rock and soil conditions, inaccessibility, limited space for auxiliary operations, and the like, pose difficult problems in preparation and layout and increase the need for inspection and control of operations.

Presence of controversy or obstructive attitudes -- Projects of larger size usually involve greater "public relations" exposure, but the nature of some projects, large or small, may be such as to arouse considerable public interest and sometimes objections to their accomplishment. For example, a relatively small public facility may have considerable impact on the economic or other interests in a small city or community. The engineer must strive to obtain acceptance and cooperation from land owners, local government groups, conservation groups, public utilities or real estate interests, or the general public to clear critical obstacles to the accomplishment of the project. To do this successfully requires experienced judgment and communications skill.

Assignment of levels under Element 2

Element 2 encompasses a range of seven levels, numbered 1 through 7, with point values of 20, 25, 30, 35, 40, 45, and 50, respectively.

The variation in scope and complexity of construction operations progresses along a continuous line, rather than by definite steps. In contrast, the definitions of levels and the numerical values assigned under this element necessarily represent definite points, rather than ranges, on this line.

This requires some flexibility in determining the level to be assigned to a position under this element. Levels 1,3,5, and 7 are described. The intermediate levels 2, 4, and 6 are to be used when the scope and complexity of assigned construction operations exceed, or do not quite measure up to, one of the defined levels.

The construction projects or operations to which an engineer is assigned may vary in complexity over a period of time, even though he is considered to be working at essentially the same level of responsibility during the period. Assignments considered in evaluating a position should cover a time period sufficient to provide a representative sampling of the level of work performed.

Careful judgment must be exercised in determining just what is the project or the construction operation with which a position is concerned in assigning a level under this element. At homes the selection of the proper level in Element 2 must depend partly on the degree evaluation made under Element 1. For example, if an engineer is responsible for construction of a major portion of a project, his/her position would appear to fall at Degree C under Element 1, and at the level of complexity assigned to the whole project under Element 2. This would be proper if his/her portion of the project were substantially representative of the range and nature of problems found in the whole project. If the assignment, however, covers construction of a portion of a very broad project that bears little relationship to the broad project in terms 'of kinds of structures and problems involved, a level under Element 2 should be selected that represents the scope and complexity of his/her portion of the project. An example of such a "portion" that would be substantially different from the project as a whole in complexity is the construction of roads, utilities systems, and community facilities for a town built to accommodate the personnel who will operate facilities in a very large project for hydropower production and irrigation.

Definitions of levels under Element 2

Level 1 (20 points)

- Projects consist mainly of one or two types of structures, requiring several months to a year to construct. Construction is accomplished by use of standard, commonly used equipment, materials and methods. The projects may present such problems as need for adapting structures to site to take advantage of already existing roads, utilities and structures, or to obtain best foundation.

  Example: Rock and earthfill dam with crest 13 meters (44 feet) high and 113 meters (370 feet) long, and reservoir of 5,609 hectare-3 decimeter (13,860 acre-feet) capacity.

- Operations in an area include a number of small projects, mainly involving a limited number of types of structures or facilities, e.g., small floodwater control structures, barracks, etc.

Foundation and soil conditions do not vary significantly in area; standard construction equipment and methods are used for all projects.

Level 3 (30 points)

! Projects include several kinds of structures and facilities construction of which would normally require 2 or years to complete; however, under accelerated scheduling, work might be completed within a year. Structures contain some "custom-built" features or specialized equipment, requiring specially adapted construction methods and equipment. Some projects require close planning and coordination of construction schedules to accommodate concurrent operation and modification of connected or related facilities and systems.

Examples:

(1) A group of barracks, administration and training buildings and facilities with features specially designed to house and support technical training operations and equipment.

(2) System of sewer forcemains, interceptors and pumping stations for an urban, industrialized area.

! Operations in an area cover several kinds of facilities, some of which require extensive treatment to correct site and foundation problems, or present problems in satisfying special "user" requirements with respect to layout and installation of systems and facilities, and finishing operations.

Examples:

(1) Floodwater retarding facilities for a soil conservation program in an area approximating a State, including dams, sediment control structures and channel improvements, and

(2) buildings, roads, and utilities to accommodate camping and recreation activities as well as special visitor centers and exhibits for the display of natural or social history collections in park areas.

Level 5 (40 points)

! Projects are characterized by (a) a variety of kinds of facilities and structural components, requiring about 4 years to construct; construction is likely to involve new and specialized equipment, materials and methods, and to present considerable site layout and foundation preparation problems; (b) a highly specialized facility requiring about 2 years to construct,

involving extensive special purpose technical equipment installation, and structural' features requiring specially adapted construction methods and quality control techniques; or (c) a series of two or three main types of structures of facilities that require about 5 years to complete construction; such an operation is subject to considerable variation in terrain, soil and climatic conditions, and requires dealing and coordinating with a number of contractors, different local government jurisdictions, business and civic groups, and landowners.

Examples:

(1) Irrigation water distribution system with three pumping plants, 62,179 meters (204,000 feet) of pipe up to 107 centimeters (42 inches) in diameter for discharge and distribution lines and laterals, power substations and distribution lines, regulating reservoirs, surge tanks and drains.

(2) Earth and rockfill dam 41 meters (133 feet high) and 695 meters (2,280 feet) long, reservoir of 105,625 hectare- 3 decimeter (261,000 acre-foot) capacity, main canal about 40 kilometers (25 miles) long and lateral canals up to 11 kilometers (7 miles) long; relocation requiring construction of several kilometers (miles) each of railroad, secondary roads, power transmission and telephone lines, carried out under a number of separate contracts.

(3) Unique facility for studying and testing the structural behavior of materials and equipment under impact, pressure, and shocks of great magnitude. The structural design and materials are unique, and require construction and installation of equipment to exact tolerances.

! Construction operations in an area include a variety of types of facilities, with considerable variations in climate and soil conditions. Such construction presents problems of adapting materials, construction methods and schedules to the different conditions.

Example: Several large housing projects, including utility and recreation facilities, located throughout the State or larger geographic area.

Level 7 (50 points)

! Projects may be (1) of a multi-facility nature, requiring about 5 years to construct; these projects present critical and varied site preparation problems and involve extensive installation of highly specialized, technical equipment and facilities; or (2) of a novel nature, such as a facility to be constructed in 2 or 3 years under accelerated schedules, involving use of new construction systems that require development and new and exacting inspection and quality control procedures, and expert troubleshooting by the engineer responsible for construction

surveillance. The engineer is subject to considerable pressure, and faces critical problems, in maintaining effective relationship with contractor, local government, business, labor and civic groups, and other interested agencies, because of urgency, scope or national policy implications of the projects.

Examples:

(1) Large hospital with highly diversified medical and scientific equipment and systems for patient care, and research and appurtenant community facilities such as quarters and residences, chapel, theater, radio station, recreation buildings and facilities, laundry, and utilities plants.

(2) A scientific complex including laboratories, computer and control centers, test sites, offices and support activities, for research, development and testing of missiles to power space flights.

(3) Large dam, reservoir and appurtenant facilities for flood control, power production and irrigation. Main features include a concrete arch dam 160 meters (520 feet) high with crest length of 442 meters (1,450 feet), radial gate controlled inclined spillway 568 meters (1,865 feet) long, power plant of 200,000KW capacity, afterbay dam and spillway, and reservoir with 556,454 hectare-3 decimeter (1,375,000 acre-feet) storage capacity.

! Area construction operations involving construction of a wide variety of facilities, including individual projects that have the scope and complexity described at Level 5, and requiring extensive public contact and coordination of the nature described above for Level 7.

GRADE-LEVEL CONVERSION TABLE

TOTAL POINTS UNDER ELEMENT 1 & 2	GRADE LEVEL
50 - 55	GS-9
65 - 70	GS-11
80 - 85	GS-12
95 - 100	GS-13
110 - 115	GS-14

Total points resulting from a number of the possible combination's fall between the ranges in the conversion table. The determination as to whether to convert to the next lower or the next higher grade should be based on application of general classification principles, considering for one thing the relative strength of the position to other positions in the organization.

The nature of responsibility encompassed by Degree E under Element 1 wants special consideration in determining the grade of positions that fully warrant Degree E, when the total point combination for these positions falls between the ranges specified in the conversion table. Normally, when this happens, the following conversion applies:

Degree E and Level 3 (90 points) = GS-13
Degree E and Level 6 (105 points) = GS-14

Point totals below 50 are not included in this conversion table, because few professional engineer positions would have full- performance assignments that warrant a lower combined point value under this standard. (Training or developmental positions should be evaluate by reference to the general criteria for grades GS-5 and GS-7.)

The definitions of Degree E under Element 1 (Level and Kind of Authority Exercised) and of Level 7 of Element 2 (Scope and Complexity of Construction Operations) do not describe ultimate situations under either element. Positions that exceed Degree E and Level 7 in difficulty and responsibility should be classified by extension of the criteria in this standard and by application of general classification principles.

Construction engineering positions may have authority and responsibilities that exceed Degree E, e.g., in extent of authority for contract changes or design changes. Also, the construction operations for which the engineer is responsible may be of greater scope and complexity than that defined in Level 7. This might occur, for example, if in addition to matching in complexity the facilities described in Level 7, the construction activities are dispersed over a wide geographic area, and involve extremely controversial and significant public interest issues.

PART IV -- FACILITIES ENGINEERING MANAGEMENT

CHARACTERISTICS OF THE WORK

Positions covered by this standard are located in programs that have an end product of construction facilities. On pages 2 and 9 of the introductory portion of this standard for the Civil Engineering Series, published December 1964, there is a discussion of the kinds of programs in which civil engineering functions occur and the kinds of facilities with which positions in the series are concerned.

To meet current and planned objectives and requirements, engineers performing Part IV functions make judgments and recommendations as to what facilities to build, with what resources, where and in what order, and take action to insure that approved facilities do get built and maintained.

While Facilities Engineering Management is associated with "constructed facilities" programs, the concern is broader than the actual construction, such as covered by Part III. Positions in Part IV may have responsibility pertaining to any or all phases of the engineering of facilities, such as the following: initiation of technical and economic feasibility studies, development and presentation of proposals for work and budget approval, planning and design, construction, and maintenance. Even within some of these phases, there is a considerable range of actions with which engineering management is concerned. For example, engineers responsible for developing programs for maintenance of facilities are concerned with a broad range of actions, including determination of feasibility and extent of work required, development of project or program proposals to obtain budget approval, preparation of designs or specifications, and accomplishment of repair and modification work.

Facilities Engineering Management does not include directive or supervisory control over accomplishment of the various phases of facilities engineering, such as planning, design, construction, or maintenance. Engineers in this functional grouping integrate and coordinate the scheduling and accomplishment of the various phases of work to insure optimum use of resources. (See discussion under Other Standards That May Be Applied concerning positions that have a combination of Facilities Engineering Management functions and supervisory responsibility.)

Civil engineers in Facilities Engineering Management often have responsibility for activities that of themselves are not within the field of engineering. They are directly assisted in some instances by nonengineering specialists who carry out these activities, such as funds control, contracting, realty acquisition and management, and the like. In the standard for Part IV we have not given much more than passing attention to the presence of such activities, since they are not material to the engineering responsibilities being measured.

As pointed out in the introductory material of the Civil Engineering standard, the coverage of a function within this standard does not imply that the function is peculiar to the civil engineering field. Professional engineers in fields other than civil may perform functions such as described under Facilities Engineering Management. *Only if the knowledges the engineer must apply are predominantly in civil engineering is the position to be classified to the Civil Engineering Series, GS-810.*

FACILITIES ENGINEERING MANAGEMENT FUNCTIONS

The characteristic functions of Facilities Engineering Management fall into three broad groups, found often in separate organizational settings. In this standard, these groups are labeled *Guidance, Development*, and *Coordination*, and contain the kinds of tasks described below:

Guidance

1. Develop procedures and instructions for determining and presenting engineering data to support project or program proposals for facilities; review proposals for validity and urgency of need, adequacy of presentation, etc.

2. Develop proposals and negotiate interagency agreements on the funding, design, construction and operation of facilities for which there is joint responsibility.

3. Conduct joint studies with other agencies, and with industry and professional groups; these studies are aimed at developing uniform systems (planning, financing, contracting) for construction and operation of facilities.

4. Recommend policies and procedures covering such things as types of work to be undertaken, the way in which engineering skills resources are to be utilized, bases for pro-rating project costs and benefits, etc. Such policies and interpretations are based on pertinent legislation, precedent court or administrative decisions, operations or conditions that facilities must support, the missions of the various agencies or groups concerned, and the construction industry market and capabilities.

5. Develop proposals for new or revised legislation, regulations or other controls over facilities programs.

6. Prepare program justifications, and explain and defend proposals before reviewing authorities, Executive or Congressional.

Development

1. Develop proposals for facilities to be built, modified or repaired. Such proposals are the basis upon which responsible authorities determine that work will or will not be done. They embody such information as the need for, and the nature, scope, and location of facilities, their cost, and, where applicable, the economic benefits to be derived and plans for repayment of costs to the Government.

2. Advise applicant or sponsor organizations concerning legislation, regulations, and policies governing nature and scope of facilities authorized, and technical standards, procedures and controls under which work will he approved and accomplished.

3. Collect and analyze data on engineering operations to determine optimum methods, equipment, and skills utilization, and to establish workload and cost standards.

4. Assess capabilities of the organization, in terms of engineering skills and time available, to undertake work of given scope and nature.

5. Develop overall work programs for accomplishing the construction and maintenance responsibilities of the organization. These programs include projects or work items, sources of funds, manpower, equipment, and materials allocations.

Coordination

1. After facilities projects or programs have been approved and budgeted, develop time-and-cost phased schedules for accomplishment of various phases of work. The schedules indicate work by portion or major component systems, and by work stages such as investigation of site conditions, design, real estate acquisition, and construction. Schedules must take into consideration the scope and nature of work to be done, target date for completion, and where (in-house, other agency, or contractor) engineering capabilities can be obtained. If work is to be contracted, participate in definition of work and negotiation.

2. Coordinate efforts of various offices, agencies and groups to obtain timely action on accomplishment of successive phases of work and assist in ironing out differences of opinion, conflicts in schedules, and interpretation of plans, designs or similar requirements.

3. Monitor progress of projects or programs through the various stages. Recommend or make adjustments in schedules or scope of work to insure that manpower and material resources, and funds, are used on a timely basis and in such manner as to produce optimum benefits, and to fulfill statutory requirements and technical objectives.

4. Provide technical advice and direction to subordinate or lateral organizations carrying out facilities engineering activities, and review their operations to evaluate progress and compliance with regulations, instructions and funding authorizations.

EVALUATION PLAN

Grade levels under Part IV are defined principally in terms of (1) the scope and complexity of facilities for which the position has engineering management responsibility, (2) the range of facilities engineering activities managed, and (3) the level of responsibility assigned.

The grade-level definitions include a description of the grade in relation to these elements, and examples of assignments that characterize that level. Positions can be properly evaluated only by

reference to the grade-level definitions as a whole. Reference to examples alone will not provide a complete grade picture.

Scope and complexity of facilities

This element deals with such influences on the level of difficulty as the following:

(1) *The scope and technological characteristics of the facilities* -- Diverse kinds of facilities that make up projects, or facilities representing the frontiers of the state of the engineering art, require greater depth and versatility of engineering knowledge and understanding in their management than do those of more limited, conventional nature.

(2) *Number and diversity of organizations involved in a facilities program* -- Engineers engaged in program functions play essentially an integrative role, so that the more separate activities, interests and participants involved, the more difficult it is to mesh efforts and ideas into a cohesive, productive project or program.

(3) *Range of jurisdictional control over facilities* -- When facilities are located in, serve, or are built under the sponsorship of a number of governmental jurisdictions (local, State, Federal), the engineer must have knowledge of the peculiarities of each, with respect to financing arrangements, building codes, land use, planning and zoning requirements, licensing, etc.

(4) *Degree of urgency and/or public interest associated with projects or programs* -- Some facilities are of urgent importance to the Nation's interest, or to the needs of an area in the conservation or development of its resources. Other facilities program proposals arouse significant public interest, often antipathy, because of their economic implications. Programing of such facilities requires the engineer to make judgments, often on the basis of a broad, well-informed background of experience without opportunity for detailed study, regarding justification of proposals from standpoint of needs and statutory requirements, alternative approaches or proposals, whether to telescope schedules, and the like.

The range of facilities engineering activities

Concern with a specific phase of facilities engineering, e.g., with maintenance (including repair, modification and operation) is less demanding than concern with a series of phases.

The level of responsibility

This element deals with the degree of guidance and control under which the engineer works. This depends both upon the responsibilities of the organization in which the engineering position is located and upon the kind of supervision received.

Some relative differentiation of level of responsibility is inherent in the functional groupings described earlier. *Guidance* functions, for example, are typical of agency policy-setting levels of organization, and carry the connotation of greater responsibility than found at "operating" levels. *Development* and *Coordination* functions may be performed at the policy-setting level, but are typically found also at intermediate and operating levels.

In the grade-level descriptions, some examples of assignments refer to the level of organization at which the functions are performed, and also to the kind of agency engineering program in which the assignments occur. These features are identified to indicate more clearly the nature and level of responsibility in the assignments described.

* * * * *

Facilities engineering programs are in agencies with three general types of engineering responsibility, which in this standard are labeled and defined as follows:

Construction agency

A. Determine what facilities are needed (and to what state or condition facilities must be repaired and maintained) to achieve specified objectives or to carry out designated operations, currently and for a projected future period.

B. Perform complete, detailed planning and design for facilities, either in-house or by contract.

C. Construct facilities, by contract or through use of own forces.

Control agency

A. Determine whether proposed facilities meet statutory and regulatory requirements (as to nature, purpose, operational capabilities, etc.), for (1) licensing by the Government, or (2) construction by non-Government agencies under Government grants or loans.

B. Review plans and designs developed by another agency (Government or applicant) to ascertain that technical needs and requirements are met.

C. Perform "third party" spot check and followup to see that contracts (planning, design, construction) are negotiated and administered to obtain optimum facilities.

Sponsor agency

(This actually has a mixture of characteristics of the first two types of programs.)

A. Determine what facilities are needed (and to what state or condition facilities must be repaired and maintained) to carry out designated operations, currently and for a projected future period.

B. Review plans and designs developed by "Construction agency" (another Government agency) to ascertain that technical needs and requirements are met.

C. Perform "third party" spot check and followup to see that contracts (planning, design, construction) are negotiated and administered to obtain optimum facilities.

Within these three types of programs, the organizational level designations have the following meanings:

"Agency level" - in Construction or Control programs, refers to the independent agency or bureau level; in a Sponsor program, to the department or independent agency.

"Intermediate level" - in a Construction or Control program, refers to the first geographic regional subdivision; in a Sponsor program, to the first organizational division level to which a discrete mission is assigned, e.g., a major military command.

"Operating level" - refers to the lowest level at which there is responsibility for carrying out a full range of facilities engineering activities, in a locality or area.

The grade levels defined in this standard are based on the assumption that the engineer is required to possess these knowledges and abilities:

- Thorough knowledge of civil engineering theory, and experience in applying that theory, and an understanding of economics, to planning, design, and construction practices.

- Broad understanding of the roles that State and local government jurisdictions and agencies play in, and the controls they exercise over, use of land and natural resources, construction of buildings and utilities, and distribution of utilities services.

- Comprehensive knowledge of the mission and organization of the employing agency, and related agencies with which facilities engineering operations must be coordinated, the

statutory and regulatory provisions and limitations on facilities engineering operations, and organizational channels for coordination and presentation of work proposals.

- Ability to recognize and evaluate important facts and considerations and to synthesize these into constructive action to accomplish facilities engineering program objectives.

- High order of skill in communicating with others-clarity and conciseness of verbal expression, and persuasiveness in obtaining the cooperation of those whose efforts he must integrate and coordinate.

The standard for Part IV does not describe grades GS-5, 7 and 9, since Facilities Engineering Management responsibility is not typical of those levels. Refer to Parts I and II for guidance in evaluation of positions at these lower grade levels.

OTHER STANDARDS THAT MAY BE APPLIED

This standard for Part IV does not provide criteria for evaluate inn positions whose primary responsibility is for supervising or directing engineering activities. Such positions are to be evaluated under the General Schedule Supervisory Guide. (When duties described under Facilities Engineering Management Functions occur as a significant, but not primary, responsibility in supervisory civil engineering positions, the criteria contained herein may be used in conjunction with the General Schedule Supervisory Guide in evaluating such positions.)

On the other hand, some positions at higher grade levels, particularly GS-14 and GS-15, have responsibility for programs of such scope that they are often assisted by other engineers over whom they may regularly exercise supervision. Some assignments of such nature are described in this standard because the engineering management responsibility, and not the supervision, constitutes the controlling basis for classifying those positions.

Some functions covered herein are carried out in organizations that carry "Plans" or "Planning" as part of their title. Part II (Planning and Design) of this standard covers functions which it defines and labels as "planning". In both Part II and Part IV, the term "Planning" relates primarily to the physical aspects of projects-the consideration of site and facility characteristics in relation to desired objectives, and the way in which alternative plans affect economic conditions. When positions have functions designated organizationally as planning, but which are concerned essentially with work such as described above under Facilities Engineering Management Functions, they should be evaluated by reference to criteria established herein (Part IV).

Some positions at higher grades, located usually at agency level, or at intermediate organizational levels, are mixed positions, combining responsibility as the consultant or authority on the design and operation of certain kinds of facilities, with facilities program management responsibility.

These positions should be evaluated as mixed positions under Part II of this standard, which covers Planning and Design functions, and under Part IV, Facilities Engineering Management.

CIVIL ENGINEER, GS-0810-11

GS-11 facilities engineering management assignments typically concern facilities in one locale or installation. While facilities are varied in type and purpose, there exist ample precedents for their planning, design and construction.

Engineers at the GS-11 level perform work such as (1) development of programs and coordination of project accomplishment with respect to maintenance, repair and minor construction for an installation or activity that has facilities to carry out a variety of operations, or that has facilities used by a number of different kinds of activities or organizations; or (2) program development covering proposed construction of a variety of new facilities for an installation or activity similar to (1) above.

The engineer usually performs such assignments under the supervision of a higher grade engineer who administers the entire facilities engineering program for the managing activity. The facilities engineering management functions are performed under comprehensive standards and guidelines issued by a higher organizational echelon, regarding justification and authorization of facilities projects and programs. Engineers at this level must apply full professional engineering knowledge and judgment in the application of standard practices, or modification of these to fit conditions that vary moderately from those previously encountered.

There is relatively limited contact with the public because of the limited facilities program. The engineer typically deals with a variety of administrative and engineering personnel within the employing organization, and in the organization of the contractors or agencies who carry out the actual construction of facilities, to obtain information and cooperation, and to furnish information about facilities engineering programs.

Examples:

(1) In a National Forest, serves as assistant to the engineer who is responsible for all engineering activities. Develops annual program proposals and work plans, and coordinates with design, construction, and operations personnel to assure their accomplishment, for maintenance, improvement, and additions to facilities to support timber operations, fire protection, water conservation, and recreation activities, including roads and bridges, drainage structures, buildings, towers, equipment shops and yards, small dams and reservoirs, and recreation area structures.

(2) Develops short- and long-range programs for maintenance and repairs of facilities for a military base which includes barracks, family housing, administrative buildings, technical or special support buildings, warehouses and community facilities. The use of the facilities is controlled by one facility manager even though more than one command is located on the base, and funding for the maintenance and repair function is through one chain of command.

(3) At the operating level under a sponsor agency, develops programs for construction and major modification of facilities for a military base complex which includes a number of activities under different commands, and which has joint use and funding with other Federal, State, and local governmental agencies on transportation and utilities systems.

(4) In a construction agency, at the operating level, performs development and coordination tasks in connection with a long-range facilities project for navigation and harbor development. Assures that various phases (planning, design, land acquisition, material and equipment procurement, and construction) are properly scheduled and integrated to meet target dates for placing facilities in operation.

CIVIL ENGINEER, GS-0810-12

The GS-12 engineer is fully responsible for development or coordination functions relating to facilities of substantial complexity and variety, possibly in a number of locations, or under the control of a number of different activity managers. This means usually that facilities engineering management must be accomplished under a number of statutory, regulatory and procedural restrictions and jurisdictions.

At an agency or intermediate level of organization, the GS-12 engineer in facilities engineering management usually serves as an assistant to a higher grade engineer, with responsibility for a portion of the facilities program assigned to that engineer. In such "assistant" assignments, the facilities for which the GS-12 engineer is responsible exceed in complexity and variety those typical of the "full responsibility" assignments described in the paragraph above.

GS-12 engineers must apply experienced professional judgment in dealing frequently with specialized facility requirements. This often requires that the engineer search out and develop new or greatly modified methods and approaches to accomplish the facility engineering management function.
GS-12 engineers work with considerable freedom from technical guidance, and their recommendations for action in matters of normal engineering practice are considered authoritative.

GS-12 engineers are expected to obtain supervisory guidance or clearance on actions that may be of a controversial nature, or that represent a new approach or course for the organization.

The presence of problems of responding to different activity requirements or standards, and of compliance with differing legal and technical requirements under various jurisdictions, differentiates this level from grade GS-11.

Examples:

(1) At the operating level of a construction agency, coordinates construction activities for a few large projects (such as for a multiple purpose dam, power plant, reservoir, and associated relocation and construction of utilities and community facilities) or for an extensive group of smaller projects (such as levees, channel improvements, bank stabilization, flood control reservoirs, and floodways). Performs a variety of tasks including:

- coordinating engineering and other technical and administrative matters between field project offices and higher levels in the organization;

- reviewing design plans and layouts prior to start of construction, for adequacy and harmony with overall, long-range facilities plans;

- advising and assisting in preparation and issuance of construction contracts, negotiation of change orders, and investigation and settlement of contractor's claims;

- conducting periodic engineering inspections of construction activities and project sites;

- initiating and coordinating measures to resolve major problems, in order to obtain scheduled progress.

(2) In a sponsor agency, performs development functions pertaining to the regular and special construction programs for an extremely large military complex on which are located a number of major commands and activities including a large port, warehouses, industrial shops, an airfield, and extensive administration, barracks and residential buildings and cornmunity facilities. Deals with numerous officials and representatives of the customer activities and the construction agency, and with the Federal, State, and local government agencies, and quasi-official groups who are concerned with regulating or furnishing utilities services, right-of-way or other land use, air approach corridors, and the like.

(3) Serves as assistant to the engineer in a construction agency who has responsibility for project development for a major class of facilities for a military bureau, to support its worldwide operations. Within the agency headquarters, serves as the primary point of information on the status of assigned projects, and coordinates to obtain necessary action by those responsible for such matters as definition of scope of work, engineering feasibility of various design approaches, funding arrangements, effect of foreign trade and shipping restrictions on cost and methods of accomplishing work, limitations of legislation, treaties and agreements on nature of projects, and the like. Projects within certain geographic areas are normally handled by specific field offices. Under special conditions, may recommend other than the normal assignment of projects, based on engineering resources or other capabilities present in particular field offices. Maintains constant contact with field offices to provide information and to follow up on their progress in carrying out the design and construction of assigned projects.

(4) As a staff assistant to an engineer who has responsibility at agency level for design, construction and operation of facilities for drainage and conservation of water on public lands, access roads, and appurtenant structures (excluding major, multi-purpose dam, reservoir and distribution facilities), carries out a variety of studies to develop standards and procedures for the control and guidance of lower organizational elements. These studies deal with matters such as:

(a) optimum project scheduling patterns to accommodate seasonal conditions and variations and to achieve balanced use of funds;

(b) the circumstances under which it is most advantageous to accomplish various phases of work in-house rather than by contract or vice versa; or

(c) the suitability of particular systems of gathering and analyzing data from an engineering viewpoint to control program operations and accomplishment.

(5) As assistant to the engineer responsible for all maintenance, repair and operation activities for the national parks in a large geographic region, performs development and guidance functions with respect to programing projects and work items needed to keep park facilities in optimum condition. The facilities serve varied activities, including scenic improvement; natural resource conservation; lodging, camping and various recreational activities; and preservation of historic buildings and sites. Because of the distinctive physical and use characteristics of each park, the considerations in determining need for work to be done, and the methods of its accomplishment cannot be highly standardized.

CIVIL ENGINEER, GS-0810-13

The GS-13 level is typified by full responsibility for development and/or coordination over a broad range of facilities engineering activities, covering a variety of complex facilities in a sizeable geographic area. Often, the facilities are under the control of a number of separate organizations. Because of the geographic dispersal of the facilities and the number of controlling organizations, the engineer must be conversant with and apply a variety of statutory, regulatory, funding, and procedural controls in facilities engineering management.

The GS-13 engineer receives assignments on the basis of recognized competence, demonstrated through considerable experience related to the area of assignment. The engineer is subject to very general supervision; work is judged mainly for achievement of productive results.

In dealing with widely scattered organizations and groups, the GS-13 engineer's contacts are initiated and carried out largely at his/her own initiative. The engineer initiates action (project directives, correspondence, reports, conferences, and the like) on all matters pertaining to the area of assignment. The engineer refers to a superior those matters that impinge on programs or projects outside his/her jurisdiction, or those that require higher echelon interpretation or formulation of policy; and discusses with the superior those matters likely to generate significant controversy or interest, or that indicate need for significant redirection of program activities.

This level differs from the GS-12 level mainly in the following respects:

- The GS-13 engineer normally acts on his/her own initiative in representing the employing organization and communicating with the varied groups concerned with the facilities engineering activities for which he/she has management responsibility. The GS-12 engineer normally obtains guidance from a supervisor concerning approaches for working out action agreements with other organizations.

- The GS-13 engineer's responsibility normally extends over the full range of facilities engineering activities, while the GS-12 engineer may be concerned only with one or two phases, e.g., with the construction phase or with maintenance repair, and operation of facilities.

- The GS-13 engineer has "full responsibility" assignments covering a wide variety of facilities, scattered over a large geographic area, while the GS-12 engineer's "full responsibility" assignments generally cover facilities in a fairly limited area.

Examples:

(1) At the operating level of a construction agency, coordinates the program for planning, designing and constructing facilities for one of the military services in an area of several States. The facilities support a considerable variety of activities, and range from administration, barracks and service facilities to hospitals, laboratories, wind tunnels, airfields, and family housing with appurtenant community facilities. In addition, complexities arise frequently from mission changes affecting the use requirements of facilities, even during construction.

The engineer must provide guidance and information to, and obtain the cooperation of officials of the military agency served, a variety of governmental officials and groups in the States and localities that have jurisdiction over economic planning, land use, utilities operation and services in areas where facilities are located, and many contractor and in-house personnel engaged in planning, designing, constructing and supplying materials for the facilities.

(2) At the operating level of a construction agency, is responsible for program development for a broad range of facilities for water resources development, control and conservation, in a watershed area covering portions of several States. The programs cover all phases of facilities engineering -- planning, design, construction operation and maintenance. The projects included range from local protection works (such as levees and channel improvements) to major multiple purpose projects (usually including facilities for power production, flood control, navigation, water supply, fish and wildlife preservation, and recreation).

Provisions for the Federal Government's participation in the construction and operation of such facilities are covered under a variety of statutes and regulations. Work on the various phases of projects extends over long periods of time. The engineer must consider and coordinate many elements relating to budget and funds requirements and availability of engineering resources.

(3) Performs program development functions with respect to varied national park and recreation area facilities in a region covering a number of States. Consults officials responsible for recreation resource planning concerning anticipated use patterns-kinds of activities, numbers of patrons, seasonal operations. Considers these factors together with the physical sources of the parks, and availability of transportation, utilities, and communications services, in recommending optimum projects for development. Collaborates with regional and State development councils, park commissions, conservation groups, highway way officials, park concessionaires, and similar involved groups, in arriving at agreements for joint development and cost sharing.

(4) At the intermediate level in a sponsor agency, performs program development and limited guidance functions pertaining to the construction and rehabilitation of family housing and appurtenant community facilities for the bases of a major military command scattered throughout the country.

(5) As the field area representative of a control agency, performs program coordination functions with respect to a wide variety of facilities constructed under various Federal loan and grant programs. These include college housing, school buildings, various public works, housing for the elderly, and related community development facilities. The coordination of facility planning and construction requires extensive contact with municipal officials, ollege officials, officials of civic, trade and labor organizations, and industrial leaders, to explain requirements and provisions of Federal programs, and to advise on planning and on applications for funds. The engineer must also maintain cognizance of the work of the planning consultants, architect-engineers, and construction contractors on projects, to insure satisfactory progress and compliance with terms of loans and grants.

(6) Performs program development and coordination functions relating to large, complex facilities that constitute major projects in an agency's construction program, e.g., monumental buildings such as a 2,000 bed structural steel multi-storied hospital, or a complex of office and laboratory buildings of comparable scope. Such projects are closely managed at agency level, because of their size and economic implications, and the need for gaining top-level Government approval and support for the agency's selection of site, and determination of scope for the projects. The facilities are characterized by a high incidence of unique features (equipment, materials, "custom" layout and space arrangements for specialized activities), and requirement for development of new approaches to design and construction. These factors impose a heavy demand upon the engineer for sound judgment in recommending or selecting contract architects and engineers with specific capabilities needed; establishing cost targets; anticipating problems in design, materials and equipment procurement, and construction in establishing realistic schedules for funding and completion of various phases; and in providing advisory and expediting services at all stages.

(7) Performs program development functions with respect to construction of airports within a region encompassing several States. These facilities range from community airfields to accommodate small privately-owned aircraft, to major centers for domestic and International airline operations. They are of crucial importance to area and community economic development, and thus are the subject of intense interest on the part of State and local government agencies, business and industry groups, and private citizens. The development of program proposals involves:

(a) discussion of the views of these groups, with respect to current and anticipated requirements for facilities to accommodate commercial passenger and freight carriers, business-owned or specialized service aircraft, and privately-owned aircraft; and

(b) consideration of these factors, together with air and ground safety requirements, anticipated aircraft developments, and capacities of existing facilities.

CIVIL ENGINEER, GS-0810-14

GS-14 engineers have facilities engineering management responsibility for highly complex, in many cases unique, kinds of facilities. They are of major importance:

(1) because of their scope and variety, and/or

(2) because they are of critical consequence in the accomplishment of missions of considerable import to the economy of an area or to the meeting of vital Government objectives.

The engineer at this level normally is assigned responsibility for guidance functions relating to the management of programs at lower levels (intermediate or operating) in the organization.

The GS-14 engineer must bring outstanding engineering ability and understanding in depth of the mission objectives supported by facilities, to anticipate major needs and problems and to provide timely and effective guidance to all elements involved in facilities engineering management.

For some of the programs assigned at this level, guidelines or precedents for managerial and technical methods for carrying out the programs are largely lacking, or only remotely applicable. Other programs at this level are covered by a great range and diversity of statutory, funding and operational controls. The engineer must apply outstanding organizing skill, and understanding of the engineering problems involved, to the development of procedures and plans for the assigned facilities engineering management activities. He has authority for establishing the management network for pinpointing action responsibility and communicating problems and progress on assigned facility programs.

The GS-14 level is differentiated from GS-13 by the presence of substantial responsibility for guidance functions, and the uniqueness or great scope of facilities assigned, necessitating a highly creative approach to developing the facilities engineering management programs and procedures.

Examples:

(1) Performs program guidance functions with reference to unusually important special projects or "one-of-a-kind" problem situations in an agency's facility program. Examples of such situations are: (1) formula for "partnership agreement" for division of financing and sharing of benefits of a multipurpose system of facilities between

Federal and non-Federal agencies; and (2) general problem of resolving areas of conflict between the programs of the two major Federal agencies concerned with water resources development, in the areas of statutory and regulatory prescriptions, objectives, scope of operations, and methods of financing of facilities.

(2) At the intermediate level in a sponsor agency, develops and coordinates the program for a large complex of unique facilities used in the research and development, fabrication, and test and evaluation of satellite launch vehicle engine and stages. Because of the developmental nature of the program that the facilities support, their nature and scope are subject to continuous modifications in character, changes in priority, and revision of funds allocation; are accomplished through use of engineering resources in-house and in other Federal agencies as well as the contractors; are virtually lacking in precedents for their design or construction. Such conditions place an unusual demand on the engineer to provide guidance to, and obtain fast and constructive results from, the various groups responsible for defining criteria, developing materials and designs, constructing facilities, and installing equipment systems, in order to project realistic, optimum schedules for completion of various phases, and to establish adequate controls over technical performance that do not impede progress.

(3) In a sponsor agency, develops the program for construction of facilities to support several types of missile programs, e.g., intercontinental defense and research satellites. Such facilities are virtually without precedent, so the engineer must define problems or areas for study and research, and use the results to formulate design and funding criteria upon which project proposals are based. Consults and coordinates with representatives from military operations, research and development, and missiles and construction industries to ascertain operations requirements and plans, new developments in equipment and systems, or new construction materials and methods-any or all of which may have bearing upon provision of optimum facilities. Prepares and presents material to Executive and Congressional reviewing authorities to justify project proposals, use of special contracting procedures, and like matters.

(4) Provides guidance to all elements involved in the planning, and is responsible for program development, covering special facilities projects for structural repair, minor construction and fire protection for one of the military departments. The work is accomplished under a variety of funds whose expenditures are controlled by numerous statutes, regulations and administrative directives. The engineer must deal with the responsible planning officials in the different commands or bureaus within the department, in order to ascertain their requirements, advise on ways to best achieve objectives from an engineering as well as a budget viewpoint, and to obtain information upon which to judge the relative needs and to establish priorities for project or work item approval.